1.5 mm wide, elliptic, glabrous, mostly purple-tinged; glume and sterile lemma equal, rather firm in texture, 5-nerved, minutely apiculate at the subacute apex; fruit pale, about the size of the spikelet, minutely papillose-striate.

Type in the U. S. National Herbarium no. 1037280, collected in the region of Lake Ypacaray, in central Paraguay, in December 1913, by Dr. E. Hassler (no. 12383).

This species belongs in the Notata group and is most nearly related to *P. almum* Chase, of Texas, southern Brazil, and Paraguay. It differs from that in the numerous short sterile shoots, the shorter much firmer blades, in the shorter stiffer racemes, and in the larger spikelets. The type collection was named by Dr. Hassler as a variety of *Paspalum notatum* Flügge. The varietal name is unpublished and cannot be used as a specific name because it is preoccupied.

Paspalum almum was described[2] from Texas. At the time I hesitated to cite the South American specimens, but further study leaves no doubt that they belong to the same species as the Texas material. Three racemes are not infrequent in the South American specimens and in one specimen there are 5 and in another 6 racemes. A specimen of this species, No. 21 *Plantae Pilcomayenses*, collected in 1906 in the Gran Chaco by Theodore Rojas, custodian of the Hassler Herbarium, was described by Hackel as *Paspalum ovale* Nees var. *apiculatum* Hack.[3] An examination of Nees' type of *P. ovale*, in the Berlin Herbarium, shows that it is not the species to which Hackel applied the name. The name "apiculatum" could not be used because it is preoccupied by *P. apiculatum* Doell, 1877.

The following South American specimens are referred to *Paspalum almum:*

BRAZIL: Porto Esperança, on Rio Paraguay, Matto Grosso, *Chase* 11078, 11095, 11109.

PARAGUAY: Gran Chaco, *Rojas* 21. Puerto Santa Rita, *Rojas* 2675 (*Hort. Paraguayensis* 11071). Rio Verde, *Herter* 4831. San Bernardino, *Rojas* 1660. Lake Ypacaray, *Hassler* 12334.

URUGUAY: Santa Rosa Cuareim, *Herter* 336 i (*Herter Herb.* 82565).

ARGENTINA: Mercedes, Prov. Corrientes, *Parodi* 6370. Formosa, *Parodi* 2936 (collector unknown).

ZOOLOGY.—*North American monogenetic trematodes.* I. *The superfamily Gyrodactyloidea.*[1] EMMETT W. PRICE, U. S. Bureau of Animal Industry.

Genus DAITREOSOMA Johnston and Tiegs, 1922

Diagnosis.—Body with constriction about one-third of length from an-

[2] This JOURNAL **23**: 137, fig. 1, 1933.
[3] Repert. Sp. Nov. Fedde **6**: 341. 1909.
[1] Continued from This JOURNAL, **27**: 114–130. 1937.

terior end; 3 pairs of head organs. Haptor not distinctly set off from body proper, with 2 pairs of large hooks—ventral pair larger than dorsal—articulating at their bases with a long, transverse, cuticular bar, and with 1 pair of marginal hooklets. Eyes present. Intestinal branches without diverticula, united posteriorly. Vitellaria not extending into posterior third of body. Vagina present.

Type species.—Daitreosoma constrictum Johnston and Tiegs, 1922.

Two species, *D. constrictum* from *Therapon carbo* Ogilby and McCulloch, and *D. bancrofti* from *T. hilli* Castelnau, have been described from Australia by Johnston and Tiegs (1922); neither of these species is known from North American hosts.

Genus Empleurosoma Johnston and Tiegs, 1922

Diagnosis.—Body with strongly developed lateral regions; 4 pairs of head organs. Haptor not distinctly set off from body proper, with 2 pairs of large hooks and 1 pair of marginal hooklets as in *Daitreosoma*. Vagina absent. Other characters as in *Daitreosoma*.

Type species.—Empleurosoma pyriforme Johnston and Tiegs, 1922.

This genus contains only the type species; it was described from the gills of an Australian fresh-water fish, *Therapon unicolor* Gunther.

Genus Anchylodiscus Johnston and Tiegs, 1922

Diagnosis.—Body without lateral constrictions and without strongly developed lateral regions. Haptor not distinctly set off from body proper, with 2 pairs of very large hooks supported by 2 cuticular bars, and with 14 marginal hooklets. Intestinal branches without diverticula and not uniting posteriorly. Eyes present. Vitellaria extending into posterior third of body. Vagina absent.

Type species.—Anchylodiscus tandani Johnston and Tiegs, 1922.

Two species have been described as belonging to this genus, namely, *A. tandani* Johnston and Tiegs from the gills of *Tandanus tandanus*, and *A. gadopsis* Hughes from the gills of *Gadopsis* sp.; both species are from Australian hosts.

Genus Murraytrema Price, 1937

Diagnosis.—Cephalic glands opening to exterior through 4 pairs of head organs. Haptor large, with 2 pairs of large hooks separated by 3 transversely placed non-articulate bars; 14 marginal hooklets. Intestinal branches not uniting posteriorly. Eyes present. Testis and ovary in equatorial zone. Cirrus with accessory piece. Vagina present, opening ventrally and medially.

Type species.—Murraytrema robusta (Murray, 1931) n. comb.

The type and only species of the genus was described as *Ancyrocephalus robusta* by Murray (1931) from specimens collected from the gills of *Sparus australis* Gunther in Australia. *Murraytrema* (Price, 1937) differs from *Ancyrocephalus* in having 3 haptoral bars instead of 2 as in the latter genus, and the vagina opens ventrally and medially in *Murraytrema* and laterally in *Ancyrocephalus*.

Genus Cleidodiscus Mueller, 1934

Diagnosis.—Cephalic glands opening to exterior through several (4 to 6) pairs of head organs. Haptor discoid, with 2 pairs of large hooks separated by 2 non-articulated bars, and with 14 marginal hooklets. Eyes present. Testis and ovary in equatorial zone. Cirrus simple, with movable accessory piece. Vitellaria extending into posterior third of body. Vagina present, opening on left body margin.

Type species.—*Cleidodiscus robustus* Mueller, 1934.

The genus *Cleidodiscus* contains the following species, all being from North American fresh-water fishes: *Cleidodiscus bedardi* Mizelle, 1926, from *Xenotis megalotis* (Rafinesque); *C. capax* Mizelle, 1926, from *Pomoxis sparoides* (Lacépède); *C. floridanus* Mueller, 1936, from *Ictalurus punctatus* (Rafinesque); *C. formosus* (Mueller, 1936), from *Pomoxis sparoides* (Lacépède); *C. incisor* Mizelle, 1936, from *Lepomis pallidus* (Mitchill); *C. longus* Mizelle 1936, from *Pomoxis sparoides* (Lacépède); *C. mirabilis* Mueller, 1937, from *Leptops olivaris* (Rafinesque); *C. pricei* Mueller, 1936, from *Ameiurus natalis* (Le Sueur) and *A. nebulosus* (Le Sueur); *C. nematocirrus* Mueller, 1937, from *Eupomotis gibbosus* (Linn.); *C. robustus* Mueller, 1934, from *E. gibbosus* (Linn.) and *Lepomis pallidus* (Mitchill); *C. stentor* Mueller, 1937, from *Amboplites rupestris* (Rafinesque); *C. uniformis* Mizelle, 1936, from *Pomoxis annularis* Rafinesque; and *C. vancleavei* Mizelle, 1936, from *P. annularis* Rafinesque.

Genus Actinocleidus Mueller, 1937

Diagnosis. Haptor disc-like, flattened, with 2 pairs of large hooks, similar and about equal in length; haptoral bars with bases articulating; 14 marginal hooklets. Cirrus with movable accessory piece. Vagina present, opening on left body margin. Other characters as in *Cleidodiscus.*

Type species.—*Actinocleidus oculatus* (Mueller, 1934) Mueller, 1937.

Representatives of this genus are known only from North American fresh-water fishes; the genus contains the following species: *Actinocleidus articularis* (Mizelle, 1936), from *Xenotis megalotis* (Rafinesque); *A. bursatus* (Mueller, 1936), from *Micropterus salmoides; A. fusiformis* (Mueller, 1934) (syn., *Ancyrocephalus cruciatus* of Cooper, 1915), from *Micropterus dolomieu* Lacépède; *A. gracilis* Mueller, 1937, from *Lepomis pallidus* (Mitchill); *A. maculatus* Mueller, 1937, from *Eupomotis gibbosus* (Linn.); and *A. oculatus* (Mueller, 1934), from *Eupomotis gibbosus* (Linn.).

Genus Aristocleidus Mueller, 1936

Diagnosis.—Large hooks of haptor dissimilar, those of ventral pair with slender, angular blades and biramous roots, while those of dorsal pair have curved blades and only slightly biramous roots; haptoral bars non-articulating; 14 marginal hooklets present. Cirrus with immovable accessory piece. Vagina present, opening on right body margin. Other characters as in *Cleidodiscus.*

Type species.—*Aristocleidus hastatus* Mueller, 1936.

This genus contains only the type species which occurs on the gills of *Roccus lineatus* in Florida. Mueller (1936) in his description of this form was in error as regards the position of the large hooks and in the number of marginal hooklets. The large hooks which he termed the ventrals are actually the dorsals and *vice versa;* there are 14 marginal hooklets instead of 12 as originally given.

Genus Tetracleidus Mueller, 1936

Diagnosis.—Haptor small, poorly set off from body. Large hooks about equal in size; bars non-articulating. Marginal hooklets probably 14 in number. Vagina present, opening on right body margin. Other characters similar to those of *Cleidodiscus.*

Type species.—Tetracleidus banghami Mueller, 1936.

This genus contains only the type species which occurs on the gills of *Micropterus dolomieu* Lacépède. It is questionable whether the genus *Tetracleidus* should be regarded as distinct from *Cleidodiscus,* since apparently the only important difference between the two genera is the position of the vaginal aperture.

Genus Leptocleidus Mueller, 1936

Diagnosis.—Haptor small, poorly set off from body. Large hooks approximately equal; bars rudimentary, non-articulating; marginal hooklets probably 14 in number. Cirrus long, slender, lying in a large coil and passing to exterior through a grooved cuticularized vestibule or accessory piece. Vagina (?). Other characters as in *Cleidodiscus.*

Type species.—Leptocleidus megalonchus Mueller, 1936.

The type and only species of this genus occurs on the gills and in the throat of *Micropterus dolomieu* Lacépède. This species appears to be the form described by Cooper (1915) as *Ancyrocephalus paradoxus.*

Genus Urocleidus Mueller, 1934

Diagnosis.—Haptor wedge shaped; large hooks of about equal size; bars non-articulating; marginal hooklets relatively small, 14 in number. Vagina absent. Other characters as in *Cleidodiscus.*

Type species.—Urocleidus aculeatus (Van Cleave and Mueller, 1932) Mueller, 1934.

The genus *Urocleidus* contains two valid North American species, *U. aculeatus* (Van Cleave and Mueller), from *Stizostedion vitreus* (Mitchill) and *U. adspectus* Mueller, 1936, from *Perca flavescens* (Mitchill).

Urocleidus angularis Mueller, 1934, from *Fundulus diaphanus menona* (Jordan and Copeland) was recently removed by Mueller (1936) from this genus to *Ancyrocephalus,* the latter being used in a general sense. The writer has studied the original specimens of *U. angularis* and is in agreement with Mueller that this species does not belong in *Urocleidus s. str.;* however, he sees no reason why it should be transferred to *Ancyrocephalus,* since it is more closely related to *Urocleidus* than to *Ancyrocephalus.*

Genus Onchocleidus Mueller, 1936

Diagnosis.—Haptor wedge-shaped, with 2 pairs of large hooks and 2 non-articulating bars; 14 marginal hooklets present, these hooklets relatively large, 6 pairs being arranged around anterior edge of haptor and having their tips directed forward. Cirrus corkscrew-shaped, or simple with spiral fin, usually with immovable accessory piece. Vagina, when present, opening on right body margin. Other characters as in *Cleidodiscus*.

Type species.—*Onchocleidus ferox* (Mueller, 1934) Mueller, 1936.

This genus contains at present 11 species, all being from North America; these are: *Onchocleidus contortus* Mueller, 1937, from *Micropterus salmoides; O. distinctus* Mizelle, 1936, from *Xenotis megalotis* (Rafinesque); *O. ferox* (Mueller, 1934), from *Eupomotis gibbosus* (Linn.); *O. helicis* Mueller, 1936, from *Micropterus salmoides; O. interruptus* Mizelle, 1936, from *Morone interrupta* Gill; *O. mimus* Mueller, 1936, from *Lepibema chrysops* (Rafinesque) and (?) *Esox reticulatus* Le Sueur; *O. mucronatus* Mizelle, 1936, from *Helioperca incisor* (Cuv. and Valenc.), *Allotis humilis* (Giard), and *Eupomotis gibbosus* (Linn.); *O. perdix* Mueller, 1937, from *Lepomis pallidus* (Mitchill); *O. principalis* Mizelle, 1936, from *Micropterus pseudaplites* Hubbs; *O. similis* Mueller, 1936, from *Eupomotis gibbosus* (Linn.); and *O. spiralis* Mueller, 1937, from *Eupomotis gibbosus* (Linn.).

Genus Pterocleidus Mueller, 1937

Diagnosis.—Each large haptoral hook with wing-like blade arising near angle and passing parallel to point for about two-thirds its length. Vagina present, opening on right body margin. Other characters as in *Onchocleidus*.

Type species.—*Pterocleidus acer* (Mueller, 1936) Mueller, 1937.

In addition to the type species, which occurs on the gills of *Eupomotis gibbosus* (Linn.), this genus contains *P. acuminatus* (Mizelle, 1936) from *Xenotis megalotis* (Rafinesque); and *P. biramosus* Mueller, 1937, from *Lepomis pallidus* (Mitchill).

Genus Haplocleidus Mueller, 1937

Diagnosis.—Large haptoral hooks similar but unequal, those of ventral pair about one-half as large as those of dorsal pair. Vagina present (?always), opening on left body margin. Other characters similar to those of *Onchocleidus*.

Type species.—*Haplocleidus dispar* (Mueller, 1936) Mueller, 1937.

This genus contains six species, namely, *Haplocleidus affinis* Mueller, 1937, and *H. dispar* (Mueller, 1936), from *Eupomotis gibbosus* (Linn.); *H. furcatus* Mueller, 1937, from *Micropterus salmoides; H. monticellii* (Cognetti de Martiis, 1925), from *Haustor catus* (Linn.); and *H. siluri* (Zandt, 1924), and *H. vistulensis* (Siwak, 1932), from *Silurus glanis* Linn.

The species described by Siwak (1932) as *Ancyrocephalus vistulensis* does not differ from *H. siluri* (Zandt), except in the number of marginal hooklets and in the character of the vagina. According to Zandt (1924) there are 16

marginal hooklets in *H. siluri*, whereas Siwak states that there are only 12 in *H. vistulensis;* apparently both figures are incorrect, the probable number in both cases being 14. Siwak states that the vagina is non-cuticularized in *H. siluri* and cuticularized in *H. vistulensis*. In spite of the differences mentioned above, the two species are identical in other respects, and both are from the same host and from the same region (Poland).

The species which Cognetti de Martiis (1925) described as *Ancyrocephalus monticellii* was collected in Italy from an American catfish. In this species the hooks of the dorsal pair were stated to be the largest; however, it seems probable from the description and figure of the bars and hooks that he was mistaken in the position of these structures, and it is on this assumption that the species is included in the genus *Haplocleidus*.

Genus Amphibdella Chatin, 1874

Diagnosis.—Body greatly elongated, fusiform; 3 pairs of head organs. Haptor lobed, distinctly set off from body proper, with 2 pairs of large similar hooks and 14 marginal hooklets; large hooks not supported by cuticular bars. Intestinal branches not united posteriorly. Eyes absent. Testis and ovary in anterior part of body, the latter elongated and curved, lying partly in extraintestinal field. Vitellaria confined to region posterior to ootype. Vagina present.

Type species.—*Amphibdella torpedinis* Chatin, 1874.

The genus *Amphibdella* contains only two species, *A. torpedinis* Chatin, 1874, and *A. flavolineata* MacCallum, 1916, the latter being a North American form.

Amphibdella flavolineata MacCallum, 1916 Figs. 1–4

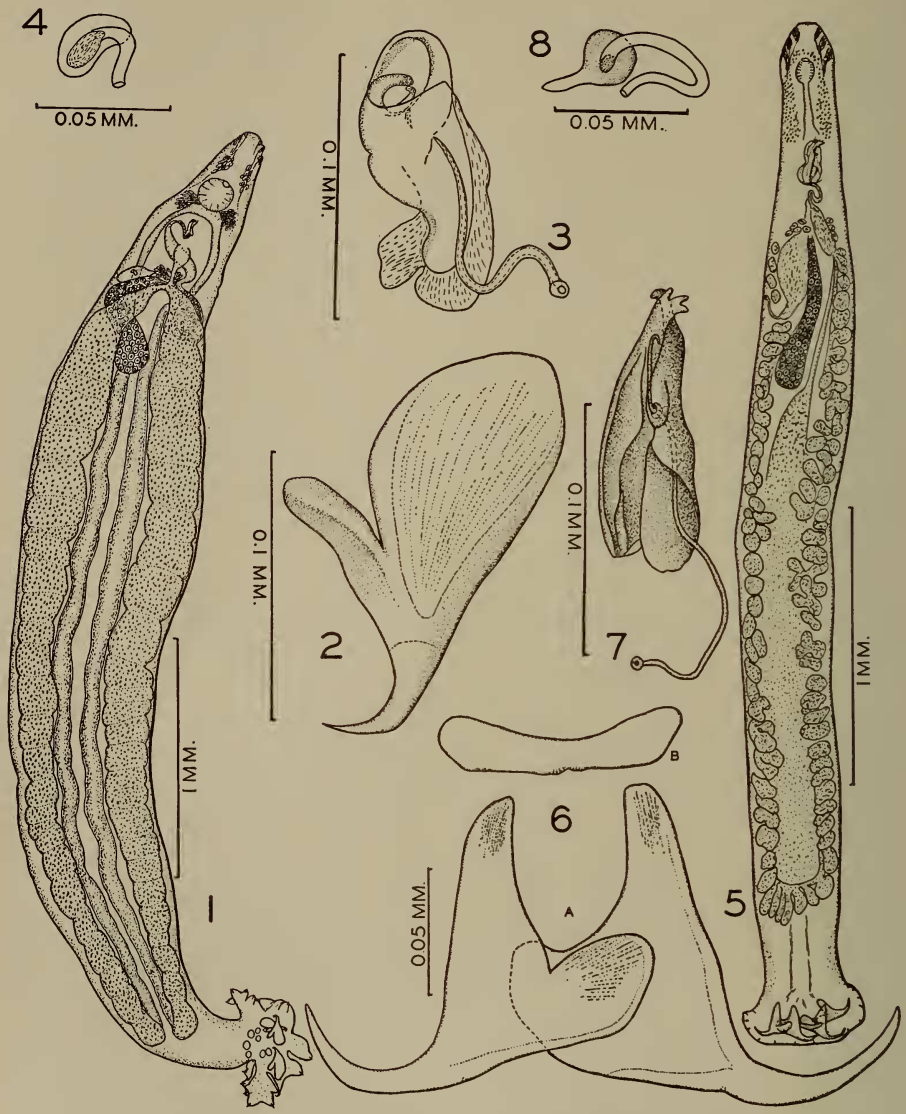
Description.—Body elongate, more or less fusiform, 3.8 to 4.3 mm long by 510 to 680μ wide. Cephalic glands lateral, prepharyngeal, opening through 3 pairs of head organs situated near anterior end. Haptor lobed, about 425 to 475μ wide, armed with 2 pairs of large similar hooks and 14 marginal hooklets; large hooks 150 to 160μ long, blade without shoulder-like process near base, otherwise similar to those of *A. torpedinis;* marginal hooklets about 10μ long, one on each lobe of haptor. Oral aperture ventral, median, about 190 to 230μ from anterior end of body; pharynx globular, 133 to 152μ in diameter; esophagus very short, with a group of unicellular glands on each side; intestinal branches simple, extending to distal limits of vitellaria, not united posteriorly. Nervous and excretory systems not observed; eyes absent. Genital aperture median, near intestinal bifurcation. Cirrus slender, tubular, about 100μ long, with very complicated accessory piece; seminal vesicle conspicuous, S-shaped. Testis single, sinistral, largely obscured by vitellaria. Ovary elongated, curved, opposite testis, lying partly in extraintestinal field. Vitellaria extracecal, consisting of large follicles arranged in linear series and extending from level of base of ootype to near posterior end of body proper. Vagina present, heavily cuticularized, near right margin of body immediately anterior to ovary, connected with a relatively large seminal receptacle. Ootype relatively slender, its base surrounded by unicellular glands. No eggs observed.

Host.—*Tetranarce occidentalis* (Storer) and "sting ray."

Location.—Gills.

Distribution.—United States (Woods Hole, Mass.).

Specimens.—U. S. N. M. Helm. Coll. Nos. 35159 (cotypes), 35204 and 35699.



Figs. 1–4.—*Amphibdella flavolineata.* 1, Complete worm, ventral view; 2, large haptoral hook; 3, cirrus and accessory piece; 4, vagina. Original. Figs. 5–8.—*Amphibdelloides maccallumi.* 5, Complete worm, ventral view; 6, haptoral hooks and bar (A—large hooks, B—bar); 7, cirrus and accessory piece; 8, vagina. Original.

Specimens of this species were collected by Dr. G. A. MacCallum at Woods Hole, Mass., July 6, 1914, and on August 21, 1922, from a torpedo,

Tetranarce occidentalis and later, July 20, 1923, a single specimen was collected by him from a "sting ray." This species is quite similar to *Amphibdella torpedinis* Chatin from which it differs principally in the morphology of the large hooks. In *A. torpedinis* the blade of the large hook is slender and widens more or less abruptly shortly before joining with the root or biramous portion, thus giving rise to a shoulder-like offset, while in *A. flavolineata* the blade of the hook is not so slender and tapers uniformly from the tip to the point of union with the root. This difference is, admittedly, slight, but constant so far as the writer has been able to ascertain. This shoulder-like offset is clearly shown in the figures of *A. torpedinis* as given by Chatin (1874) and by Ruszkowski (1931). In addition to the hooks, there appears to be considerable difference in the male copulatory organ.

Genus Amphibdelloides Price, 1937

Synonym.—*Amphibdella* Chatin, 1874, in part.

Diagnosis.—Haptor not lobed; large hooks supported by a single cuticular bar. Other characters as in *Amphibdella.*

Type species.—*Amphibdelloides maccallumi* (Johnston and Tiegs, 1922).

Amphibdelloides maccallumi (Johnston and Tiegs, 1922), n. comb. Figs. 5–8

Synonyms.—*Amphibdella torpedinis* Perugia and Parona, 1889, not Chatin, 1874; *A. torpedinis* MacCallum, 1916, not Chatin, 1874; *A. maccallumi* Johnston and Tiegs, 1922.

Description.—Body slender, 1.1 to 3.5 mm long by 255 to 476μ wide. Cephalic glands abundant, forming a band across body anterior to pharynx and extending backward on each side to near level of genital aperture, opening to exterior through 3 pairs of head organs situated near anterior end of body. Haptor not lobed, 210 to 425μ wide, armed with 2 pairs of large hooks and 14 marginal hooklets, the large hooks supported by a single cuticular bar; large hooks 133 to 170μ long, shape similar to those of *Amphibdella flavolineata;* marginal hooklets about 10μ long; cuticular supporting bar slightly curved, 64 to 95μ by 19μ, concavity directed anteriorly. Oral aperture ventral, median, about 133 to 170μ from anterior end of body; pharynx globular, 76 to 95μ in diameter; esophagus relatively long. Nervous and excretory systems not observed; eyes absent. Genital aperture median, near intestinal bifurcation. Cirrus slender, tubular, about 175μ long; accessory pieces 2 in number, one with single curved tip and other tridigitate, about 130 to 160μ long. Testis elongate, median. Ovary elongate, slightly curved, median, pretesticular. Vitellaria lateral, consisting of large follicles uniting and forming a band across body at level of tips of intestinal ceca. Vagina slender, heavily cuticularized, opening near right margin of body at level of middle of ovary, and communicating with a large seminal receptacle lying along right margin of anterior part of ovary. Ootype and metraterm not discernable in available specimens. No eggs observed.

Hosts.—*Tetranarce occidentalis* (Storer) and *Squalus acanthias* Linnaeus.

Location.—Gills.

Distribution.—United States (Woods Hole, Mass.).

Specimens.—U. S. N. M. Helm. Coll. Nos. 35700 (cotypes), 25701 and 35652.

This appears to be the species described as *Amphibdella torpedinis* by Perugia and Parona (1889) and later redescribed by Parona and Perugia (1890) from specimens obtained from *Torpedo marmorata* in the Mediterranean region. Perugia and Parona show that the large haptoral hooks are supported by a single transverse bar, but in the redescription they report the species as having 2 bars; this latter report appears in the light of the present study to be an error.

The specimens upon which the above description is based were collected by Dr. G. A. MacCallum at Woods Hole, Mass., and described by him in 1916 as *Amphibdella torpedinis* Chatin.

This species resembles *Amphibdella torpedinis* and *A. flavolineata* in a general way but differs from them in having an unlobed haptor and large hooks supported by a transverse cuticular bar.

Genus Tetrancistrum Goto and Kikuchi, 1917

Diagnosis.—Anterior end with 2 to 3 pairs of head organs. Haptor small, not distinctly set off from body proper, with 2 pairs of similar, and almost equal, large hooks supported by 2 cuticular bars, and sometimes, if not always, with (?) 14 marginal hooklets. Intestine united posteriorly. Eyes absent. Vagina present.

Type species.—*Tetrancistrum sigani* Goto and Kikuchi, 1917.

Tetrancistrum longiphallus (MacCallum, 1915), n. comb. Figs. 9–11

Synonyms.—*Diplectanum longiphallus* MacCallum, 1915; *Ancyrocephalus longiphallus* (MacCallum, 1915) Johnston and Tiegs, 1922.

Description.—Body more or less fusiform, 1.4 mm long by 255μ wide; cephalic glands opening through 2 pairs of head organs. Haptor 133μ wide, not distinctly set off from body proper, provided with 2 pairs of large hooks supported by 2 transverse bars, and with a number, possibly 14, marginal hooklets. Large hooks about equal in size, 57μ long, differing only slightly in morphology; ventral bar 53μ long, narrow, bifid at ends; dorsal bar 38μ by 15μ; marginal hooklets very delicate, about 10μ long. Oral aperture ventral, about 95μ from anterior end of body; pharynx 75μ long by 53μ wide; intestine not observed. Eyes absent. Cirrus simple, tubular, about 140μ long; seminal vesicle curved, to left of ootype. Testis elongate oval, somewhat lobed, about 300μ long by 95μ wide, postequatorial. Ovary oval, about 150μ long by 60μ wide, immediately pretesticular. Vitellaria extending from level of pharynx to about 250μ from posterior end of body, meeting in median field posterior to testis. Vagina present, opening near right margin of body near level of base of cirrus. Ootype elongated, its base surrounded by long-necked unicellular glands. Egg oval, about 75μ long by 50μ wide, with relatively long filament at one pole.

Host.—*Chaetodipterus faber* (Broussonet).

Location.—Gills.

Distribution.—United States (New York Aquarium).

Specimens.—U. S. N. M. Helm. Coll. No. 35702 (cotypes).

This species was described under the name *Diplectanum longiphallus* by MacCallum (1915) from specimens collected from the gills of a spade fish, January 23, 1915, at the New York Aquarium. The material consists of a

few badly preserved and distorted specimens, only one specimen being in a suitable condition for description. A comparison of the available specimens with the description as given by MacCallum shows that the original description is inadequate in many respects. The measurements are not in agreement with those obtained by the present writer, the mouth is ventral instead of terminal, and no eyes are present; the cirrus is much shorter than MacCallum's measurements indicate, being about 140μ long instead of 250μ and the egg is about 75μ long instead of 20μ as stated by MacCallum.

A comparison of this species with descriptions of *Tetrancistrum sigani* Goto and Kikuchi (1917) from *Siganus fuscescens* Houttuyn from Japan, and of *T. lutiani* Tubangui (1931) from *Lutianus lioglossus* (Bleeker) from the Philippines, indicates that *Diplectanum longiphallus* MacCallum belongs in the genus *Tetrancistrum* rather than in *Diplectanum*, or in *Ancyrocephalus* where it was placed by Johnston and Tiegs (1922). The small size of the haptor, the similarity of the anterior and posterior hooks, the stalked Mehlis' glands, and the absence of eyes are characters which suggest affinities with *Tetrancistrum* rather than with *Ancyrocephalus;* the absence of squamodiscs alone excludes this species from *Diplectanum.*

Tetrancistrum longiphallus may be easily distinguished from the other two species of *Tetrancistrum* on the morphology of the large haptoral hooks and of the ventral bar. The hooks of *T. longiphallus* have blades more widely curved and longer than those of the other species, and the ventral bar is bifid at the extremities instead of rounded as in *T. sigani.*

Goto and Kikuchi (1917), as well as Tubangui (1931), state that the marginal hooklets of the haptor are absent in the genus *Tetrancistrum.* In *T. longiphallus* marginal hooks were found to be present although the exact number was not ascertainable; these hooklets are very small and transparent, and could be definitely detected only after careful study under an oil immersion objective. The fact that these hooklets are difficult to detect suggests that they were overlooked by the above mentioned authors.

GENUS INQUIRENDUM

Dactylodiscus Olsson, 1893

Diagnosis.—Cephalic glands and head organs (?); haptor pedunculated, lobed, with 2 pairs of hooks, the dorsal hooks being the largest, and having a peculiarly-shaped middle piece; marginal hooklets (?). Eyes present. Testis and ovary entire, equatorial. Cirrus simple. Vagina (?).

Type species.—Dactylodiscus borealis Olsson, 1893.

This inadequately characterized genus was proposed by Olsson (1893) for *D. borealis,* a species, found on the gills of *Thymallus vulgaris* and *Coregonus lavaretus.* Johnston and Tiegs regard *Dactylodiscus* as a subgenus of *Ancyrocephalus,* but owing to the inadequacy of the description of the type and only species, the writer prefers to retain it as a *genus inquirendum* until a more complete description is available.

Subfamily DIPLECTANINAE Monticelli, 1903

Synonym.—Lepidotreminae Johnston and Tiegs, 1922.

Diagnosis.—Body, especially posterior half, covered with anteriorly directed scale-like spines; cephalic glands present, opening to exterior through head organs. Posterior haptor with accessory structures (dorsal and ventral) or "squamodiscs," consisting of sessile or subsessile discs covered with concentric rows of scale-like spines, or of lamellae, with or without accessory hooks; haptor with 2 pairs of large hooks and basal supporting bars, and usually, if not always, with 14 marginal hooklets. Intestinal branches ending blindly, without diverticula. Eyes present, 2 pairs. Cirrus simple or complex. Testis and ovary without lobes. Vagina present.

Type genus.—*Diplectanum* Diesing, 1858.

KEY TO GENERA OF DIPLECTANINAE

1. Squamodiscs consisting of concentric rows of paired lamellae..... .....*Lamellodiscus* Johnston and Tiegs
   Squamodiscs consisting of concentric rows of scale-like spines or spine-like hooks.....2
2. Squamodiscs with backwardly projecting groups of spine-like hooks.... .....*Lepidotrema* Johnston and Tiegs
   Squamodiscs without spine-like hooks.....*Diplectanum* Diesing

Genus DIPLECTANUM Diesing, 1858

Synonyms.—*Acleotrema* Johnston and Tiegs, 1922; *Lepidotes* Johnston and Tiegs, 1922; *Squamodiscus* Yamaguti, 1934.

Diagnosis.—Squamodiscs consisting of concentric rows of scale-like spines, without groups of accessory spine-like hooks. Large hooks of haptor supported by 3 transverse cuticular bars. Vagina present or (?) absent.

Type species.—*Diplectanum aequans* (Wagener, 1857) Diesing, 1858.

The genus *Diplectanum* has been considered as identical with *Ancyrocephalus* by most recent writers, including Johnston and Tiegs (1922), Fuhrmann (1928), Van Cleave and Mueller (1932) and Sprehn (1933). A review of the status of *Diplectanum*, however, indicates that it must be retained as a genus distinct from *Ancyrocephalus*.

Diplectanum was proposed as a genus (not as a subgenus as Maclaren (1903) stated) by Diesing (1858) to include *Dactylogyrus aequans* Wagener, 1857, and *D. pedatum* Wagener, 1857. The genus was defined by Diesing as follows: "*Plectana* duo sessilia vel pedicellata.—*Piscium* marinorum ectoparasitica.—Characteres reliqui ignoti."

The two species *D. aequans* and *D. pedatum*, which Diesing included in this genus, were named but not described by Wagener (1857a) who later in the same year (1857b) gave a brief characterization of these species; this description was barely generic but apparently enough to validate the species. Diesing did not designate a type for his genus *Diplectanum* and inasmuch as he listed *D. aequans* first, Stiles and Hassall (1908) have indicated that species as "probably type," therefore, for all intents and purposes *D. aequans* (Wagener) may be regarded as type by subsequent designation.

Apparently the reason that *Diplectanum* has not been more generally

recognized as a valid genus was owing to the very meagre characterization of the species included in that genus, but if one regards Wagener's (1857b) description as sufficient to validate the species, as the present writer does, the genus must also be regarded as valid. Wagener's description is as follows:

"Dactylog. aequans (Branch. Labrax lupus) und pedatus (Julis spec. inc.) haben statt einer Schwanzscheibe deren zwei; die Innenfläche dieser Organe ist mit in konzentrische Kreise gelegten Stäbchen bekleidet."

"Die beiden Schwanzscheiben sind durch einen 3gliedrigen Apparat getrennt, dessen äussere Enden die scheerenartig gegeneinander beweglichen 2 grossen Hakenpaare tragen."

"Die grossen Haken haben stets häutige Scheiden, deren Oeffnung meist von einer festen Einfassung umgeben ist."

Van Beneden and Hesse (1863), Stossich (1896) and Maclaren (1903) have given descriptions of a species from *Labrax lupus*, which they regard as *D. aequans*. These descriptions are of a worm the characters of which conform to those given above for *Diplectanum*, and in view of the fact that the worm described by these different authors was from *Labrax lupus*, the same host as that reported for *D. aequans* by Wagener, and from the same general geographic region, the writer believes that the species they had before them was *D. aequans* (Wagener).

In view of the above, it appears that Johnston and Tiegs, as well as the other writers who have apparently followed their action, erred in considering *Diplectanum* as a synonym of *Ancyrocephalus*, since the type species *A. paradoxus*, of the latter genus lacks the two accessory structures (squamodiscs) which are characteristic of *D. aequans* and, accordingly, of the genus *Diplectanum*.

The genus *Diplectanum* contains the following species: *D. aculeatum* Parona and Perugia, 1889; *D. aequans* (Wagener, 1857); *D. americanum* n. sp.; *D. collinsi* (Mueller, 1936); *D. echeneis* (Wagener, 1857); *D. fluviatilis* (Johnston and Tiegs, 1922); *D. girellae* (Johnston and Tiegs, 1922); *D. longipenis* (Yamaguti, 1934); *D. pedatum* (Wagener, 1857); and *D. sciaenae* Beneden and Hesse, 1863. Of these species, *D. pedatum* from *Julis* sp.; *D. sciaenae* from *Sciaena aquilla; D. aculeatum* from *Corvina nigra;* and *D. echeneis* from *Chrysops aurata, Sargus rondeletii* and *Pagrus vulgaris* are inadequately described, although they probably are distinct species. Only two species, *D. collinsi* (Mueller) from *Roccus lineatus*, and *D. americanum* n. sp., are known to occur in North America.

Diplectanum americanum, n. sp. Figs. 12–15

Description.—Body elliptical, 765μ to 1.1 mm long by 210 to 390μ at level of ovary; posterior part of body armed with anteriorly directed scale-like spines extending forward almost to level of testis; anterior end of body rounded; cephalic glands present, opening to exterior through 4 pairs of head organs. Posterior haptor 170 to 190μ wide, with dorsal and ventral

squamodiscs, and armed with 2 pairs of large hooks supported by 3 transverse cuticular bars, and with 14 marginal hooklets. Squamodiscs subsessile, about 120μ in diameter, each consisting of 20 concentric rows of scales; hooks of ventral pair 76μ long, those of dorsal pair 50μ long; lateral supporting bars 76μ long, middle bar 114μ long, marginal hooklets about 10μ long. Oral aperture ventral, about 117μ from anterior end of body; pharynx about 38μ in diameter; intestinal branches not observed. Brain immediately anterior to pharynx; eyes present, 2 pairs, those of anterior pair smaller than those of posterior pair. Genital aperture not observed; male copulatory organ conspicuous, consisting of a simple cuticular tube (cirrus) 38μ long and a reniform, apparently heavily cuticularized structure (?) ejaculatory bulb) 87μ long by 38μ wide, divided by septa into 4 compartments. Testis globular, about 45μ in diameter, slightly postequatorial. Ovary piriform, 38μ wide, partly overlapping testis. Vitellaria extending from level of posterior margin of pharynx to within short distance of anterior margins of squamodiscs. Vagina present; Mehlis' gland conspicuous, surrounding ootype. No eggs observed.

Host.—*Promicrops itaiara* (Lichtenstein).

Location.—Gills.

Distribution.—United States (New York Aquarium).

Specimens.—U. S. N. M. Helm. Coll. No. 35703 (type and paratypes).

The above description is based on 5 stained and mounted specimens, collected by Dr. G. A. MacCallum, September 3, 1914, from *Promicrops guttatus* (=*P. itaiara*) at the New York Aquarium. Owing to the rather poor condition of the specimens, some of the details could not be made out. This species is easily distinguished from all other species of the genus by the peculiar structure of the male copulatory organ.

Genus Lepidotrema Johnston and Tiegs, 1922

Synonyms.—*Flabellodiscus* Johnston and Tiegs, 1922; *Empleurodiscus* Johnston and Tiegs, 1922.

Diagnosis.—Dorsal and ventral squamodiscs composed of concentric rows of scale-like papillae, each with a number of backwardly projecting spine-like hooks arranged in a fan-like manner; large hooks of haptor supported by 4 cuticular bars articulating with a more or less complex central piece. Vagina present or absent.

Type species.—*Lepidotrema therapon* Johnston and Tiegs, 1922.

This genus and the subgenus *Flabellodiscus* (also used in the sense of a genus by Johnston and Tiegs), as well as *Empleurodiscus*, were proposed by Johnston and Tiegs (1922) for small monogenetic trematodes occurring on the gills of Australian fresh water fishes of the genus *Therapon*. These genera were regarded as distinct on the basis of characters such as the width of the haptor in comparison with body width, on the number of accessory spine-like hooks of the squamodiscs, and on the complexity of the male copulatory organs. In the writer's opinion these characters are of specific rather than generic value, and *Flabellodiscus* and *Empleurodiscus* are dropped as synonyms of *Lepidotrema*.

The genus as here constituted contains the species *Lepidotrema therapon*

Johnston and Tiegs, from *Therapon carbo* Ogliby and McCulloch; *L. tenue* Johnston and Tiegs, 1922, from *T. hilli* Castelnau; *L. fuliginosum* Johnston and Tiegs, 1922, from *T. fuliginosus* Macleay; *L. simplex* (Johnston and Tiegs, 1922), from *T. fuliginosus* Macleay; *L. angustus* (Johnston and Tiegs, 1922), from *T. unicolor* Gunther; and *L. bidyana* Murray, 1931, from *Therapon bidyana* (Mitchell).

Genus Lamellodiscus Johnston and Tiegs, 1922

Diagnosis.—Dorsal and ventral squamodiscs consisting of numerous concentric rows of paired lamellae; large hooks of haptor supported by 3 cuticular bars. Vagina present.
Type species.—*Lamellodiscus typicus* Johnston and Tiegs, 1922.

In addition to *Lamellodiscus typicus*, which occurs on the gills of *Sparus australis* Gunther, Murray (1931) has described two species, *L. pagrosomi*, from *Pagrosomus auratus*, and *L. major* from *Sparus australis*. All three of the species are known only from Australia.

Subfamily BOTHITREMATINAE Price, 1936

Diagnosis.—Cephalic glands scattered throughout the preoral part of body and not arranged in lateral groups as in other members of family, opening to exterior through 4 pairs of cup-like head organs. Haptor disc-like, with 1 pair of large hooks separated by 2 cuticular bars, and with 14 marginal hooklets; in addition to hooks and other cuticular structures, a row of radially arranged tube-like cuticular structures are present near the margin of the haptor. Intestine single, sac-like. Eyes present. Testis single, postovarial. Vagina (?).
Type genus.—*Bothitrema* Price, 1936.

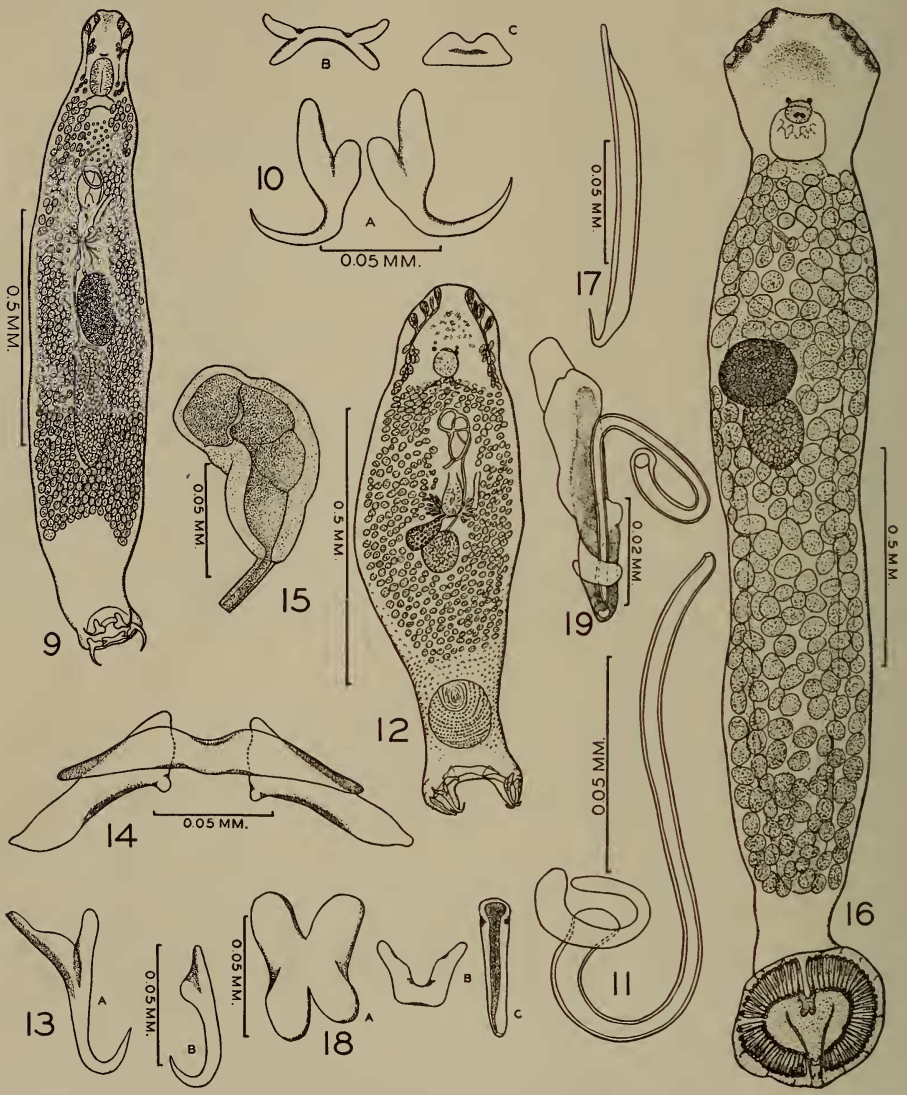
Genus Bothitrema Price, 1936

Synonym.—*Acanthocotyle* Monticelli, 1888, in part.
Diagnosis.—With characters of subfamily.
Type species.—*Bothitrema bothi* (MacCallum, 1913) Price (1936).

Bothitrema bothi (MacCallum, 1913) Price, 1936 Figs. 16–19

Synonym.—*Acanthocotyle bothi* MacCallum, 1913.
Description.—Body elongate, 1.4 to 2.5 mm long by 255 to 390μ wide, with distinct constriction in region of pharynx; anterior end angular, with 4 pairs of head organs apparently representing concentrations of ducts of numerous cephalic glands distributed throughout preoral portion of body. Haptor disc-like, 285 to 340μ in diameter, its ventral surface concave and bearing 1 pair of large hooks, 14 marginal hooklets, 2 cuticular bars—1 ventral and the other dorsal—and 52 to 60 radially arranged cuticular tube-like structures. Large hooks 120 to 133μ long, their distal ends sharply pointed and recurved, and separated near their tips by a U-shaped cuticular bar 20 to 25μ long by 22 to 30μ wide; ventral cuticular bar somewhat H-shaped, 57μ long by 40μ wide, located between bases of large hooks; radial cuticular structures 65 to 90μ long; marginal hooklets 15μ long. Oral aperture ventral, 114 to 200μ from anterior end of body; pharynx rectangular, 100 to 114μ long by 95 to 136μ wide, its anterior end with papilla-like

projections; intestine single, median, sac-like, extending posteriorly as far as limits of vitellaria. Brain antero-dorsal of oral aperture; eyes present, 2 pairs, one pair close together and immediately dorsal of oral aperture and the other pair farther apart and at level of anterior margin of oral opening,



Figs. 9–11.—*Tetrancistrum longiphallus.* 9, Complete worm, dorsal view; 10, haptoral hooks and bars (A—large hooks, B—ventral bar, C—dorsal bar); 11, cirrus. Original. Figs. 12–15.—*Diplectanum americanum.* 12, Complete worm, ventral view; 13, large haptoral hooks (A—hook of ventral pair, B—hook of dorsal pair); 14, haptoral bars; 15, copulatory organ. Figs. 16–19.—*Bothitrema bothi.* 16, Complete worm, ventral view; 17, large haptoral hook; 18, supporting structures of haptor (A—ventral bar, B—dorsal bar, C—one of tube-like accessory structures); 19, cirrus and accessory piece. Original.

or slightly more anterior to that point. Genital aperture ventral, median, about midway between ovary and pharynx; cirrus simple, tubular, about 75μ long, with complicated accessory piece about 55μ long. Testis single, globular, 130 to 170μ in diameter, median, immediately postovarial. Ovary globular, 150 to 170μ in diameter, about one-third of body length from anterior end and to right of median line; Mehlis' gland voluminous, immediately preovarial. Vitelline follicles numerous, large, about 40 to 50μ in diameter, extending from level of base of pharynx to near posterior end of body. Vagina not observed. Egg triangular, 50μ wide, and with polar filament, according to MacCallum.

Host.—*Lophopsetta maculata* (Mitchill).

Location.—Gills.

Distribution.—United States (Woods Hole, Mass.).

Specimens.—U. S. N. M. Helm. Coll. No. 35186 (cotypes), 35704, 35705 and 35706.

This species was originally described by MacCallum (1913) as *Acanthocotyle bothi* from specimens collected in 1912 from *Bothus maculatus* (=*Lophopsetta maculata*). The description contained a number of errors of interpretation of the various structures, which he later (1916) attempted to correct. Unfortunately, however, he carried over into the redescription many of the errors originally made. The most outstanding of the misinterpretations not corrected in the latter description were in regard to the number of testes, the character of the intestine, and the nature of the radial structures on the posterior haptor. According to MacCallum (1913) "there are about thirty-seven testes," but actually there is only a single testis located immediately posterior to the ovary and this is the structure labeled "seminal reservoir" in his figure; the structures which MacCallum regarded as testes were the large vitelline follicles lying over the intestinal cecum and which, owing apparently to some error of technique, took the stain somewhat differently from the other follicles. The intestine consists of a single sac-like structure and not 2 ceca as indicated by MacCallum. The radial structures on the posterior haptor are not "really hooklets" as MacCallum stated, but are rather heavily cuticularized tube-like pieces imbedded in the haptor.

This species is apparently an aberrant member of the Dactylogyridae standing in a position intermediate between that family and the Monocotylidae. Its lack of laterally arranged cephalic glands suggests affinities with the Monocotylidae, but the presence of cuticular supporting bars between the large hooks excludes it from that family.

MacCallum's inclusion of this form in the genus *Acanthocotyle* was apparently due to a misconception, since he regarded the tube-like structures on the posterior haptor as structures comparable to the radially arranged spines on the pseudohaptor[2] of *Acanthocotyle*.

[2] The large terminal disc of *Acanthocotyle* is probably not homologous with the haptor of the tristomes, monocotylids and gyrodactylids, but is an added structure, the true haptor being the minute hook bearing disc located at the margin of the large disc or pseudohaptor.

Family CALCEOSTOMATIDAE (Parona and Perugia, 1890) emend. Price, 1937

Synonym.—Calceostomidae Parona and Perugia, 1890.

Diagnosis.—Cephalic gland ducts not concentrated into head organs but remaining scattered over a considerable area on either side of anterior end of body, the anterior end being expanded and forming head lappets. Haptor sucker-like but not strongly muscular, with or without large hooks, with or (?) without marginal hooklets. Intestine with short diverticula. Eyes present or (?) absent. Testis single. Cirrus simple, cuticularized. Vagina present or absent.

Type genus.—*Calceostoma* Beneden, 1852.

KEY TO GENERA OF CALCEOSTOMATIDAE

Vagina absent.....*Calceostoma* Beneden
Vagina present.....*Fridericianella* Brandes

Genus Calceostoma Beneden, 1852

Diagnosis.—Anterior end of body expanded and forming large curled head lappets. Haptor cup-shaped, armed or (?) unarmed. Intestinal limbs with numerous short diverticula. Eyes present. Testis elongated. Ovary branched. Vagina absent.

Type species.—*Calceostoma calceostoma* (Wagener, 1857) Johnston and Tiegs, 1922.

This genus contains 3 species, *C. calceostoma* (Wagener, 1857) (syn., *C. elegans* Beneden, 1858), *C. inerme* Parona and Perugia, 1889; and *C. glandulosum* Johnston and Tiegs, 1922. No representative of the genus has been reported from North America.

Genus Fridericianella Brandes, 1894

Diagnosis.—Head lappets not as prominent as in *Calceostoma*. Haptor cup-like, with 1 pair of small centrally placed hooks; marginal hooklets (?) absent. Eyes absent. Intestinal branches with lateral diverticula, united by commisure posterior to testis. Testis single, rounded. Ovary tubular, median. Vagina present, opening laterally near equator of body.

Type species—Fridericianella ovicola Brandes, 1894.

This genus contains only the type species which was described by Brandes (1894) from specimens collected from the eggs of *Arius commersonii* Lac., a fresh- and brackish-water fish from South Brazil.

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